DEVELOPMENT OF INTERACTIVE PHYSICS MODULES BASED ON AGRICULTURAL SYSTEMS TO IMPROVE STUDENTS' LEARNING OUTCOMES

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Abstract

This research aims to develop an interactive physics learning module based on agricultural systems in Polewali Mandar Regency. This module is designed to enhance students' understanding of physics concepts applied in real-world contexts, particularly in the agricultural sector, which is the primary sector in the region. The interactive approach used aims to make students more active in the learning process by utilizing technology to enrich teaching materials and increase student engagement. The development method applied uses the ADDIE model (Analysis, Design, Development, Implementation, and Evaluation), which includes needs analysis, design of agriculture-based content, development of interactive materials, implementation in teaching, and evaluation of the module's effectiveness. The research results show that the use of this module can significantly improve students' learning outcomes. The improvement in learning outcomes is measured through pre- and post-test assessments, as well as observations of student engagement during the learning process. Students demonstrated a better understanding of physics concepts relevant to their lives, as well as improved skills in applying physics knowledge in the context of agriculture. Therefore, this module is expected to be an innovation in improving the quality of physics education in Polewali Mandar Regency, particularly in applying physics knowledge to local agricultural system.

Keywords: Module development, Physics learning, Interactive, Agricultural system, Learning outcomes, Polewali Mandar.

1. Introduction

Education is one of the key elements in the development of quality human resources. Science education, particularly physics, plays a vital role in shaping students' critical and analytical thinking skills, which are essential in facing the global challenges of the 21st century. However, physics education in Indonesia often faces various challenges, including the lack of relevant and interactive learning resources, as well as students' low interest in the subject.

These challenges are particularly evident in certain regions, such as Polewali Mandar Regency in West Sulawesi, where the majority of the population is involved in agriculture. Many students in this area come from farming families and are involved in daily agricultural activities. However, physics teaching in schools in Polewali Mandar often still uses conventional approaches that do not consider the local context. As a result, students find it difficult to relate physics concepts to real-life experiences in their environment. This highlights the need for innovation in teaching methods that can bridge the gap between physics theory and real-world practices.

To address this issue, innovative efforts are needed in the development of contextual and relevant teaching materials. Teaching materials not only enhance the quality of learning but also serve as supporting tools for educators, as well as a means of conveying messages and other functions (Aprilia, 2018).

The lack of teaching materials has been proven to hinder the development of students' abilities. Most classroom learning tends to show that teachers are more focused on lecturing, media are underutilized, classroom management is mostly traditional, and learning activities are less varied (Sagala, 2009). As seen in SMK Negeri Luyo, students expressed that the learning conducted was still not engaging overall, with most classroom activities relying on the lecture method and the teaching materials not addressing real-life situations. As a result, students struggle to visualize the material they have learned and can only understand the theory, which ultimately affects their learning outcomes.

The results of discussions between the researcher and several physics teachers revealed that, until now, there has been no physics teaching material related to agriculture, and teachers have never created teaching materials that can be used in the learning process, either as teacher's handbooks or as independent learning materials for students. The lack of teaching material development at the school is due to time constraints.

In the learning process, it is crucial to develop teaching materials that are comprehensive, concise, engaging, and creative to help students understand the concepts they will be learning. One of the efforts to improve the quality of education is through the development of learning resources. Teaching materials are developed as an effort to improve the quality of education. Teaching materials essentially play several roles for teachers, students, and in the learning activities.

There are several types of teaching materials, including printed materials, audiovisual materials, and manipulative tools. Teaching materials are systematic, meaning they are structured to facilitate students' learning. One source of teaching materials that can be used is a module (Sugiyono, 2014, in LM. Zulfahrin).

Learning using modules provides students the opportunity to learn at their own pace or ability. This means that students who can learn faster can continue their studies without waiting for those who learn more slowly. Similarly, students with slower learning abilities can have more time to study. This learning process emphasizes individual students to learn independently without teacher guidance. The role of the teacher here is only as a facilitator, so it is expected that students will be motivated and will improve their learning performance (Wahrini, 2021).

Based on the issues outlined, the researcher will develop teaching materials in the form of an interactive physics module based on local agricultural systems. This module is designed to integrate physics concepts with various aspects of agriculture that are familiar to students, such as the working principles of agricultural tools, irrigation mechanisms, and natural phenomena related to agricultural processes.

This module is equipped with various interactive media, such as images, videos, and animations, that can facilitate active and collaborative learning. Teachers can use this module to provide a more varied and engaging learning experience for students, thereby increasing student involvement in the learning process. Additionally, this module can assist teachers in integrating technology into teaching, which is one of the demands in today's digital era.

Based on these explanations, the researcher has chosen the title "Development of an Interactive Physics Module Based on Agricultural Systems in Polewali Mandar." Through this physics learning module, it is hoped that it will make a significant contribution to improving the quality of physics education in Polewali Mandar. By providing relevant and interactive learning resources, students will find it easier to understand physics concepts and apply them in everyday life, thereby improving their learning outcomes

2. Methodology

The research method used for the development of the interactive physics module based on agricultural systems in Polewali Mandar is the Research and Development (R&D) method. This approach aims to produce a product that can be used in physics learning, particularly related to its application in the agricultural sector in the region. The following are the steps that can be applied in this research method:

2.1 ADDIE Model

The ADDIE model (Analysis, Design, Development, Implementation, and Evaluation) is used in this research. The steps are as follows:

2.1.1 Analysis

In this phase, an analysis is conducted to identify the needs of students in Polewali Mandar regarding their understanding of physics, as well as the identification of physics topics relevant to agricultural systems. Analysis is also carried out on the availability and accessibility of technology and the existing educational conditions in the region.

2.1.2 Design

Based on the analysis results, the next step is to design the learning module. This design includes determining learning objectives, selecting appropriate content, and planning the use of supporting interactive media. The design of the module also considers how to integrate physics concepts with real-world applications in the agricultural sector.

2.1.3 Development

In this phase, the interactive physics learning module is developed. This includes creating learning materials, designing an interactive interface, and conducting initial testing of the developed module. The module development also includes integrating relevant agricultural content with physics topics to ensure the connection between physics theory and real-world practice.

2.1.4 Implementation

The developed module is then implemented in physics lessons in the classroom. A pilot test of the module is conducted with students in Polewali Mandar, both through face-to-face learning and technology-based learning. Observations of student interactions and the teaching-learning process are made to assess the module's effectiveness.

2.1.5 Evaluation Design

In this phase, an evaluation of the success and effectiveness of the module is conducted based on student learning outcomes. Evaluation is carried out by collecting data through pre-tests and post-tests to measure students' understanding improvement. Additionally, feedback from students and teachers is gathered to refine the module.

2.2 Quasi-Experimental Design

To measure the effectiveness of the module, a quasi-experimental design can be applied. One group of participants is tested before and after the intervention to observe any changes. Student learning outcomes are measured through pre-test and post-test assessments. Comparing these test results can reveal the impact of the interactive module on student learning outcomes.

2.3 Data Analysis Techniques

The data collected through learning outcome tests, observations, and feedback from students and teachers will be analyzed quantitatively by comparing pre-test and post-test scores. Statistical tests will be used to determine any significant differences.

3. Results and Discussion

3.1 Needs Analysis

Surveys and interviews with students and teachers revealed a lack of engaging physics teaching materials. Most teachers relied on textbooks without integrating local agricultural contexts, leading to disengagement among students. The findings highlighted the necessity of an interactive module tailored to their environment

3.2 Prototype Development

The module was designed using Canva software, incorporating visuals, videos, and animations to enhance learning. Expert validation confirmed the theoretical accuracy of the content. Teachers provided positive feedback, suggesting minor design improvement

3.3 Learning Outcomes

The given diagram is a 3D bar chart that visually represents a comparison between pre-test and post-test scores. The title of the chart, "Skor Pretest Postest," translates to "Pre-test and Post-test Scores" in English. This chart is used to illustrate the improvement in learning outcomes after a specific intervention, most likely an educational module or instructional strategy.

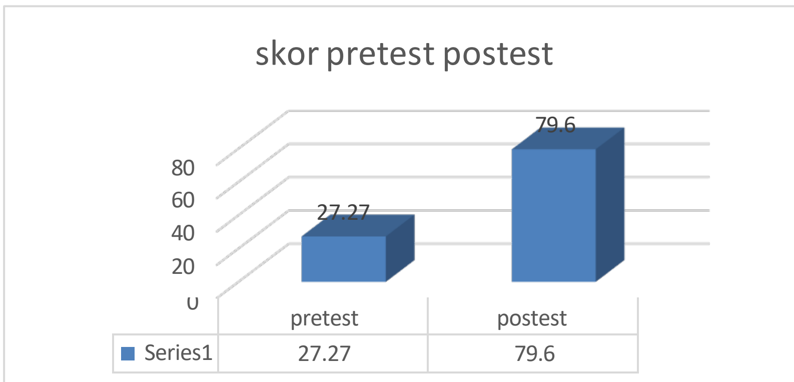

Figure 3. The Post-test and Pre-test Scores Diagram of Students.

The X-axis of the chart represents two categories: pre-test and post-test, indicating the assessment stages before and after the learning process. The Y-axis represents the score scale, which ranges from 0 to 100. The chart contains two vertical bars, both of which are colored in blue. Each bar represents the average score of students before and after using the interactive physics learning module.

The first bar, labeled as pre-test, shows a score of 27.27, indicating the students' initial performance before they were exposed to the learning module. This relatively low score suggests that students had limited understanding of the subject matter before the intervention. It also indicates a need for enhanced learning strategies to help students grasp the material more effectively.

In contrast, the second bar, labeled as post-test, shows a significantly higher score of 79.6. This considerable increase in scores reflects a substantial improvement in students' comprehension and mastery of the subject matter after engaging with the interactive physics learning module. The difference in scores between the pre-test and post-test, which is 52.33 points, suggests that the educational intervention had a strong positive impact on student learning outcomes.

The large gap between the two bars highlights the effectiveness of the learning approach, demonstrating that students were able to retain and apply knowledge more efficiently after using the new module. This suggests that the interactive and contextualized teaching method, which integrates agricultural systems into physics learning, successfully enhanced student engagement and understanding. The incorporation of real-world applications in the module likely helped students relate physics concepts to their everyday experiences, making the subject more relevant and easier to comprehend

Additionally, the significant increase in scores implies that students became more motivated and actively participated in the learning process. This also suggests that the interactive module provided a more engaging and effective way of learning compared to traditional teaching methods, which often rely on lectures and passive learning. In conclusion, this 3D bar chart effectively demonstrates the success of the interactive physics learning module in improving student learning outcomes.

The drastic improvement in post-test scores compared to pre-test scores signifies that students benefited greatly from the newly implemented instructional approach. These findings indicate that using interactive, context-based learning materials is an effective strategy for enhancing students' understanding and performance in physics, particularly when integrated with real-life applications such as agricultural systems. This approach can serve as a model for future curriculum development in other subjects, helping bridge the gap between theoretical knowledge and practical applications.

4. Conclusion

The interactive physics learning module effectively integrates agricultural concepts with physics education, making the subject more relevant and engaging for students in Polewali Mandar. The module's interactive approach enhances motivation and comprehension, improving overall learning outcomes. Positive feedback from students and educators confirms its potential as an innovative tool in physics education. Future research should explore broader implementations and refinements to maximize impact.

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